

Research evaluating some energy-saving protocols at the MAC layer for wireless sensor networks

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Abstract: This study evaluates the energy efficiency of several Medium Access Control (MAC) layer protocols for Wireless Sensor Networks (WSNs). Given that sensor nodes are typically battery-powered and deployed in inaccessible environments, minimizing energy consumption is critical for extending network lifetime. The research focuses on a comparative analysis of key protocols, including S-MAC, T-MAC, and B-MAC, which employ different strategies such as duty cycling, adaptive listening, and preamble sampling to reduce idle listening and collisions. Through simulation using NS-2, the protocols are assessed based on metrics including average energy consumption, packet delivery ratio, and end-to-end delay under varying traffic loads. The results demonstrate that while S-MAC effectively reduces energy waste through periodic sleep schedules, T-MAC offers improved adaptability to traffic fluctuations at the cost of higher latency. B-MAC, with its low-power listening mechanism, shows superior performance in low-traffic scenarios. The findings provide a comprehensive framework for selecting the most suitable MAC protocol for specific WSN applications, balancing energy savings against network performance requirements.

Keywords: energy-efficient MAC protocols, wireless sensor networks, MAC layer, energy saving evaluation